versity, 2000*l.*; (H) Scottish universities, 42,000*l.*; (I) colleges, Great Britain, 100,000*l.*; (J) university colleges, Wales, 12,000*l.*; (K) Welsh university and colleges, additional grant, 15,000*l.*; increase, 15,000*l.* University College of North Wales (building fund), decrease, 20,000*l.* Provision is made as follows in other estimates for expenditure in connection with the University of London:—buildings, external maintenance and repairs, 3358*l.*; rates, 4500*l.*; non-effective, 1317*l.*; total, 9175*l.*

THE *Times* announces that "the German Aërial Navy League is organising a school for aëronauts which, it is said, will be opened at Friedrichshafen on October 1 of this year. The object of the school is to provide the necessary scientific and practical training for the crews of military and other airships. Only those who have been through an 'intermediate' school and, in addition, have worked for a year in engineering shops, will be admitted as pupils. The course will extend over three years, of which the first will be devoted to theoretical instruction, the second to work in a construction yard, and the third to ascents in airships and flying machines." This announcement will be read with the more interest as a somewhat similar project forms a part of the programme of the recently formed Aërial League of Great Britain, the inaugural meeting of which at the Mansion House was so highly successful. It is much to be hoped that the promoters of the English scheme will succeed in maintaining the same high standard of admission, and the same length of training, that are contemplated in the above notice. It would be highly undesirable that an institution founded for the training of aëronauts should have to waste its resources by providing classes in elementary calculus and mechanics such as can be found at any technical college.

THE National Union of Teachers held its annual conference of delegates at Morecambe from April 10 to 15, and the meeting was thoroughly successful and the discussions full of interest, notwithstanding the rather unusual circumstance that there was no new Education Bill to be considered. The president, Mr. C. W. Hole, delivered the inaugural address, in the course of which he stated that the elementary schools have made great progress during recent years. The ancient system of payment by results has passed away, leaving all concerned happier and better for its disappearance; the liberty and confidence reposed in the teachers have resulted in the children being, not only rationally instructed, but also more properly educated. It remains for the Government to provide financial assistance in order that the size of the classes may be reduced and the staff rendered efficient in number and quality. In this connection Mr. Hole warmly approved Mr. Runciman's recent staffing circular. Resolutions were carried unanimously (1) in favour of larger grants from the National Exchequer; (2) regretting attempts made by certain local authorities to repudiate settled contracts of teachers in their service. At the sectional meetings papers were read by Mr. C. H. Wyatt and Mr. Ernest Gray on the supply and training of teachers, by Mr. A. R. Pickles on leaving examinations and scholarship competitions, and by Mr. Charles Bird on the teaching of handwork. Mr. Pickles quoted with approval the report of the British Science Guild on the relations of primary and secondary education, particularly the recommendation that the reports of teachers should supersede largely the present system of estimating ability by examinations.

THE Colonial Conference in 1907 pronounced in favour of reciprocity between the Governments and examining bodies throughout the Empire. The council of the Surveyors' Institution has taken an important step forward by submitting a memorandum to the Colonial Secretary, which Lord Crewe has approved and dispatched to the officers administering the Governments of Canada, Newfoundland, Australia, New South Wales, Victoria, Queensland, South Australia, Western Australia, Tasmania, New Zealand, Cape of Good Hope, Natal, Transvaal, and Orange River Colony. The memorandum states that under existing conditions a surveyor has to pass examinations and comply with requirements, varying in different parts of the Empire, before he is allowed to practise. It is hoped, as a result of the present movement, to arrive at a uniform standard of qualification. A surveyor would then, having taken his diploma in England or one of the colonies, be eligible to practise in any part of the Empire, subject to an examination in the local land laws and conditions. In the event of an Imperial conference of surveyors being held, it will take place at the Surveyors' Institution, and the chief points, so far as they have been formulated, for discussion would probably be the desirability of establishing reciprocity throughout the Empire:—(*a*) that a candidate must have matriculated at some recognised university, or passed an equivalent examination; (*b*) that an examination in the theory of land surveying be then taken, the standard of this examination to be as high as that now in force in South Africa; (*c*) that the candidate be then required to pass an examination in practical surveying, and that he be ineligible to sit for this final examination until he has had at least two years' experience with a practising surveyor.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 10, 1908.—"The Specific Heat of Air and Carbon Dioxide at Atmospheric Pressure, by the Continuous Electrical Method, at 20° C. and at 100° C." By W. F. G. **Swann.** Communicated by Prof. H. L. Callendar, F.R.S.

The continuous electrical method possesses two main advantages over the method of mixtures; it enables the specific heats to be measured over small ranges of temperature, and further, the elimination of the heat loss does not depend upon the results of a set of experiments in which the conditions are different to those which hold in the main experiments. The mean of a large number of measurements of the specific heats, agreeing to about 1 part in 1000, gave the following results:—

Air	Carbon dioxide.
0·24173 cal. per gram degree at 20° C.	0·20202 cal. per gram degree at 20° C.
0·24301 ,, ,, 100° C.	0·22141 ,, ,, 100° C.

An accurate comparison with the values deduced on theoretical considerations from Joly's measurements at constant volume can be made in the case of air, and the agreement is shown to be nearer than to 1 part in 1000. The comparison can only be made in a rough manner for carbon dioxide, and the agreement is to 1 per cent.

The results obtained are about 2 per cent. higher than those obtained by former investigators. The experiments of Regnault are discussed as a typical example, and it is pointed out that an uncertainty amounting to 5 per cent. (tending to make the results too low) probably exists in those experiments, owing to the fact that the heat loss was determined by a set of observations in which the conditions were different to those which held in the main experiments.

March 25.—Sir Archibald Geikie, K.C.B., president, in the chair.—Liberation of helium from radio-active minerals by grinding: J. A. **Gray.** (1) Helium is liberated from thorianite, and a liberation of 28 per cent. has been effected; (2) the smaller the mineral is ground the more helium is liberated; (3) this liberation has a temporary limit when the mineral is reduced to a size of about 3μ; (4) it is impossible to say how the remaining 72 per cent. of helium is contained in the mineral, and to how much finer than 1 μ the mineral would have to be reduced to liberate the helium.—The expulsion of radio-active matter in the radium transformations: Sidney **Russ** and W. **Makower.** When the radium emanation is transformed into radium A, the process is accompanied by the emission of α particles with a velocity of $1{\cdot}70\times10^9$ centimetres per second. The portion of the atom from which the α particle has been emitted, which constitutes the radium A, must therefore recoil in a direction opposite to that in which the α particle is projected. If we further consider that the mass of the α particle is 4(H=1), and that of the active deposit of the order 100, it follows that at the moment of its formation this product must be travelling with a velocity of the order 10^7 centimetres per second. In ordinary circumstances, when the emanation is mixed with air at atmospheric pressure, the radium A particle

will possess only sufficient energy to permit it to travel a fraction of a millimetre before being stopped by collision with air molecules. On the other hand, at very low pressures, these particles should travel considerable distances without being stopped by the rarefied air, and come to rest on the enclosure containing the emanation. The case is similar for the formation of radium B from radium A. To investigate these phenomena, discs were suspended, *in vacuo*, above surfaces rendered active by the various disintegration products of radium, and the activity obtained on the discs after exposure was measured in the normal manner by a quadrant electrometer. The principal results obtained in this paper may be summarised as follows:—(1) When radium emanation, in radio-active equilibrium with its products of disintegration, is condensed at the bottom of an evacuated tube immersed in liquid air, active deposit particles are radiated up the tube. This phenomenon is ascribed to the recoil of the residual atom when an α particle is emitted. (2) The law of absorption of this radiation, both in air and hydrogen, has been investigated. The radiation reaching a surface at a fixed distance from the condensed emanation is an exponential function of the gas pressure. (3) From the rate of decay of the activity collected on a surface exposed to the radiation from the emanation, it appears that both radium A and radium B reach the surface. (4) Radium B and radium C are both radiated through a vacuum from a surface previously rendered active by exposure to the emanation. Supposing that radium B emits only β particles, the radiation of radium C must be due to the recoil of the atoms when β particles are emitted.—*Sphaerostoma ovale*, n. gen., and *Crossotheca Grievii*, n. spec., an account of the structure and relations of the reproductive organs of *Heterangium Grievii*: Dr. Margaret **Benson.** *Sphaerostoma ovale* (*Conostoma ovale et intermedium*, Williamson) is the earliest Palæozoic ovule so far known structurally. It is a small ovule 3·5 mm. in length, and shows the same general type of organisation as the "Lagenostoma" series of ovules. The pollen-chamber, however, does not engage with the micropyle, but opens and closes with a very perfect mechanism, somewhat reminiscent of the peristome and epiphragm of Polytrichum. The paper also deals with the relation of this ovule to *Heterangium Grievii*, and with a new Crossotheca which is attributed to the same plant.

Physical Society, March 26.—Dr. C. Chree, F.R.S., president, in the chair.—The production of steady electrical oscillations in closed circuits, and a method of testing radio-telegraphic receivers: Dr. J. A. **Fleming** and G. B. **Dyke.** By the use of two such nearly closed oscillatory circuits, one being employed as a transmitting station and the other as a receiving station, these being placed at a distance of a few hundred yards from each other, what is practically equivalent to radio-telegraphic stations with open oscillators at very large distances can be constructed. Methods were described for producing in one of the closed circuits extremely constant damped oscillations by means of an induction coil or transformer, a spark-gap on which a steady jet of air is allowed to impinge, and a suitable mercury break. Means were described for ascertaining when the current in this transmitting circuit is constant. Instances were given of the ease with which detectors of various types, such as a magnetic detector, electrolytic detector, crystal detector, and ionised gas detector, could be compared for relative sensibility.—Effect of an air blast upon the spark discharge of a condenser charged by an induction coil or transformer: Dr. J. A. **Fleming** and H. W. **Richardson.** When an oscillatory discharge of a condenser takes place across the spark-gap in the usual manner by charging the condenser by an induction coil or transformer, the intermittent spark which takes place is a complex effect. It consists partly of a true condenser discharge and partly of an alternating-current arc due to current coming directly out of the induction coil or transformer. This arc discharge is a source of difficulty in making accurate quantitative measurements with electrical oscillations, and to produce a uniform oscillatory discharge this true arc discharge must be prevented or arrested. It was shown in the paper that this can be done by a regulated air blast produced in any convenient manner, thrown upon the spark-gap, provided that the spark-gap is small. The paper also described experiments made to investigate the effect of breaking up the spark-gap into smaller spark-gaps in series, both when the gaps were subjected to an air blast and also without the air blast.—The action between metals and acids and the conditions under which mercury causes evolution of hydrogen: Dr. S. W. J. **Smith.** The action between an acid and a metal, which results in the replacement of hydrogen, can be formulated without the aid of any hypothesis beyond the assumption that it is approximately reversible. The mode of formulation suggests a kinetic picture of the process by which equilibrium is in certain cases attained. This was described by the author, and it was pointed out that if a steady state is reached, after a certain quantity of hydrogen has been evolved, it will be defined by an equation of the form $ah\mathrm{M}=bm\mathrm{H}$. In this, a and b are constants at a given temperature, h and m are the concentrations of the hydrogen ions and of the metal ions respectively in solution, and H and M are specific constants of hydrogen and of the metal. The experiments described in the paper may be regarded as an attempt to justify the above equation when the metal is mercury.

Zoological Society, April 6.—Mr. F. Gillett, vice-president, in the chair.—Description of a new form of Ratel (Mellivora) from Sierra Leone, with notes upon the described African forms of this genus: R. I. **Pocock.**—An ichthyosporidian causing a fatal disease in sea-trout: Muriel **Robertson.**—A small series of fishes from Christmas Island, collected by Dr. C. W. Andrews: C. Tate **Regan.** Seven new species were described, comprising five blennies, a Pampeneus, and a Cirrhites. In connection with the last-named, it was pointed out that the Cirrhitidæ, as defined and limited by Dr. Günther, with the addition of Haplodactylus, form a very natural family.—Some new and little-known Hesperidæ from tropical West Africa: H. H. **Druce.** The paper contained remarks on, and descriptions of, some new forms of these butterflies lately obtained by Mr. G. L. Bates on the Ja River, Cameroons, and others from Nigeria. New species of the genera Abantis, Acleros, Gorgyra, Parnara, and Ceratrichia were described.

PARIS.

Academy of Sciences, April 13.—M. Bouchard in the chair.—The diffraction of Hertzian waves: H. **Poincaré.**—A general solution of the spectroheliograph: H. **Deslandres.** The spectroheliograph described, which is installed at Meudon, consists of four different spectroheliographs arranged round one collimator and astronomical objective, and controlled by four synchronised electric motors. These spectrographs are arranged for different classes of work, some having two and others three slits. The apparatus has already given interesting results on the black filaments of the upper layers of the solar atmosphere, especially the images of K_3 and $H\alpha$.—The transformations of the associated O networks: C. **Guichard.**—The integration of certain functional inequalities: Arnaud **Denjoy.**—A problem of Fourier: Henri **Larosse.**—The action of a continuous current on symmetrical chains of electrolytes not having common ions: M. **Chanoz.** Study of the gases disengaged by the action of copper salts on steels: E. **Goutal.** Three steels were studied, containing respectively 0·29, 0·64, and 1·38 per cent. of carbon, the solution used for the attack being that of the double chloride of copper and potassium containing a few drops of hydrochloric acid to the litre. The carbon dioxide, carbon monoxide, and hydrocarbons evolved were determined separately. The loss of carbon thus determined amounted to 0·01 to 0·05 per cent., and this loss is reduced by about one-half if the carbon in the residue is estimated without drying.—The quantitative analysis of the occluded gases in the lava from the last eruptions of Mt. Pelée and Vesuvius: M. **Grossmann.** Estimations were made of the total quantity of gas per 100 grams, and figures given for the amounts of carbon dioxide, oxygen, nitrogen, hydrogen, carbon monoxide, and methane. The various products from Vesuvius show marked differences in the quantity and composition of the gases evolved.—

The distribution of ferments in plant members and tissues: C. **Gerber.**—The hypotensive function of choline in the organism: Jean **Gautrelet.** By means of the Florence reaction, choline has been recognised in various glands of the horse, sheep, pig, ox, and dog. The hypotensive action of the alcoholic extract is shown to be due to the choline present, since this action disappears if the choline is precipitated. The alcoholic extract of the glands exactly neutralises the hypertensive action of adrenalin.—The intra-dermo-reaction to tuberculin in the treatment of tuberculosis: Charles **Mantoux.** The intradermal reaction can be used to measure the sensibility of the subject, and to control the quantity of tuberculin necessary for injection. The local reactions serve as a guide for the conduct of the treatment, and render it much more certain.—The treatment of genito-urinary troubles by direct action on the nervous centres: Pierre **Bonnier.** Details are given of the beneficial effects of slight cauterisations of the nasal mucous membranes in various diseases, especially those connected with the genito-urinary functions.—Sero-anaphylaxis of the dog: Maurice **Arthus.**—Sero-anaphylaxis of the rabbit: Maurice **Arthus.**—Some new facts concerning the transgressivity and the tectonic observed in the mountains of Algeria and Tunis: J. **Roussel.**—The polar magnetic storms in 1882 and 1883: M. **Birkeland.**

DIARY OF SOCIETIES.

THURSDAY, APRIL 22.

ROYAL SOCIETY, at 4.30.—Dynamic Osmotic Pressures: The Earl of Berkeley, F.R.S., and E. G. J. Hartley.—(1) The Theory of Ancestral Contributions in Heredity; (2) The Ancestral Gametic Correlations of a Mendelian Population Mating at Random: Prof. Karl Pearson, F.R.S.—The Intracranial Vascular System of Sphenodon: Prof. A. Dendy, F.R.S.—On the Graphical Determination of Fresnel's Integrals: J. H. Shaxby.

MATHEMATICAL SOCIETY, at 5.30.—The General Principles of the Theory of Integral Equations: F. Tavani.—The Equations of Electrodynamics and the Null Influence of the Earth's Motion on Optical and Electrical Phenomena: H. R. Hassé.—The Solution of a Certain Transcendental Equation: G. N. Watson.—The Physical Applications of Certain Conformal Transformations of a Space of Four Dimensions and the Representation of a Space Time Point by Means of a Sphere: H. Bateman.—Some Criteria for the Residues of Eighth and Other Powers: A. E. Western.—On the Discontinuities of a Function of One or More Real Variables: Dr. W. H. Young.

INSTITUTION OF MINING AND METALLURGY, at 8.—The Valuation of Mining Areas on the Rand: W. Fischer Wilkinson.—The "Wholesale" Idea in Gold Mining: W. R. Feldtmann.—The Computation of the Present Value of Developed and Undeveloped Mines: W. H. Goodchild.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Electrical System of the London County Council Tramways: J. H. Rider.

FRIDAY, APRIL 23.

ROYAL INSTITUTION, at 9.—Tantalum and its Industrial Applications: A. Siemens.

PHYSICAL SOCIETY, at 5.—On a Want of Symmetry shown by Secondary X-Rays: Prof. W. H. Bragg, F.R.S., and J. L. Glasson.—Transformations of X-Rays: C. A. Sadler.—Theory of the Alternate Current Generator: Prof. T. R. Lyle.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Development of Hydro-electric Power Schemes; with Special Reference to Works at Kinlochleven: J. M. S. Culbertson.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Presidential Address: J. A. F. Aspinall.

SATURDAY, APRIL 24.

ROYAL INSTITUTION, at 3.—The Earth Movements of the Italian Coast and their Effects: R. T. Günther.

MONDAY, APRIL 26.

ROYAL SOCIETY OF ARTS, at 8.—Aërial Flight: F.W. Lanchester.

INSTITUTE OF ACTUARIES, at 5.—Notes on Mortality and Life Assurance in India: A. T. Winter.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Road Motors ("James Forrest" Lecture): Colonel H. C. L. Holden, F.R.S.

TUESDAY, APRIL 27.

ROYAL INSTITUTION, at 3.—The Brain in Relation to Right-handedness and Speech: Prof. F. W. Mott, F.R.S.

ROYAL STATISTICAL SOCIETY, at 5.

ZOOLOGICAL SOCIETY, at 8.30.

FARADAY SOCIETY, at 8.—Experiments on the Current- and Energy-Efficiencies of the Finlay Alkali Chlorine Cell: Dr. F. G. Donnan, Dr. J. T. Barker, and B. P. Hill.—On the Coefficients of Absorption of Nitrogen and Oxygen in Distilled Water and Sea-water, and of Atmospheric Carbonic Acid in Sea-water: Dr. C. J. J. Fox.—On the Electromotive Force of Certain Platinum Compounds, with Special Reference to the Oxygen-Hydrogen Gas Cell: Dr. P. E. Spielmann.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Annual General Meeting.

WEDNESDAY, APRIL 28.

GEOLOGICAL SOCIETY, at 8.—The Boulders of the Cambridge Drift: their Distribution and Origin: R. H. Rastall and J. Romanes.—The Nephrite and Magnesian Rocks of the South Island of New Zealand: A. M. Finlayson.

ROYAL SOCIETY OF ARTS, at 8.—The Resources of the Peruvian Andes and the Amazon: C. R. Enoch.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.

THURSDAY, APRIL 29.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: A Phenomenon connected with the Discharge of Electricity from Pointed Conductors (with a Note by Prof. J. Zeleny): Prof. H. T. Barnes and A. N. Shaw.—On the Effect of Temperature on Ionization: J. A. Crowther.—The Wave-making Resistance of Ships; a Theoretical and Practical Analysis: T. H. Havelock.—The Ionisation in Various Gases by Secondary γ Rays: R. D. Kleeman.

ROYAL SOCIETY OF ARTS, at 4.30.—The Problem of Indian Labour Supply: S. H. Fremantle.

FRIDAY, APRIL 30.

ROYAL INSTITUTION, at 9.—The Pitfalls of Biography: Dr. Edmund Gosse.

SATURDAY, MAY 1.

ROYAL INSTITUTION, at 3.—The Earth Movements of the Italian Coast and their Effects: R. T. Günther.

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